

# **SOUTHGATE SUBDIVISION (PWS 3140114) SOURCE WATER ASSESSMENT FINAL REPORT**

---

**March 21, 2002**



## **State of Idaho Department of Environmental Quality**

**Disclaimer:** This publication has been developed as part of an informational service for the source water assessments of public water systems in Idaho and is based on data available at the time and the professional judgement of the staff. Although reasonable efforts have been made to present accurate information, no guarantees, including expressed or implied warranties of any kind, are made with respect to this publication by the State of Idaho or any of its agencies, employees, or agents, who also assume no legal responsibility for the accuracy of presentations, comments, or other information in this publication. The assessment is subject to modification if new data is produced.

## Executive Summary

Under the Safe Drinking Water Act Amendments of 1996, all states are required by the U.S. Environmental Protection Agency (EPA) to assess every source of public drinking water for its relative sensitivity to contaminants regulated by the Act. This assessment is based on a land use inventory of the designated assessment area and sensitivity factors associated with the wells and aquifer characteristics.

This report, *Source Water Assessment for Southgate Subdivision, Caldwell, Idaho*, describes the public drinking water system, the boundaries of the zones of water contribution, and the associated potential contaminant sources located within these boundaries. This assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. **The results should not be used as an absolute measure of risk and they should not be used to undermine public confidence in the water system.**

The Southgate Subdivision drinking water system consists of two wells. Well #1 supplies drinking water to the northern half of the subdivision while Well #2 supplies drinking water to the southern half. Well #1 has high susceptibility to inorganic compounds (IOCs) and a moderate susceptibility to volatile organic compounds (VOCs), synthetic organic compounds (SOCs), and microbial contaminants. Well #2 has a high susceptibility to all potential contaminant categories with an automatic high susceptibility to microbial contaminants due to a detection of total coliform bacteria at the wellhead in 1995. The high susceptibility ratings of Well #2 can be attributed to the high hydrologic sensitivity around the well and the insufficient flood protection of the well, resulting in a high system construction score. The extensive irrigated agricultural land within the area of the wells also contributed to the overall susceptibility of both wells.

The current water chemistry issue affecting the wells of the Southgate Subdivision pertains to the detection of the total coliform bacteria in Well #2. In April 1995, total coliform bacteria were detected at the wellhead of Well #2. However, there has been no further detection of bacteria in either well or in the distribution system.

No VOCs or SOCs have been detected in the drinking water system during any water tests. The IOCs barium, arsenic, nitrate, and fluoride have been detected in the water system, but at levels below the maximum contaminant levels (MCLs) set by the EPA. However, both arsenic and nitrate have been detected in both wells at levels greater than one-half the current MCLs. In 1995, arsenic was detected in Well #1 at 15 parts per billion (ppb) and in Well #2 at 9 ppb. In 1998, no arsenic was detected in Well #1 and 6 ppb of arsenic was detected in Well #2. The EPA lowered the arsenic standard from 50 ppb to 10 ppb in October 2001, giving public water systems until 2006 to comply with the new standard. Since 1993, nitrate concentrations in Well #1 have ranged from 8.86 parts per million (ppm) in 1997 to 5.8 ppm in 1999 with a recent detection of 8.16 ppm in 2000. For Well #2, the concentrations have ranged from 5.77 ppm in 1997 to 7.37 ppm in 2000. The nitrate MCL is 10 ppm. In addition, the surrounding agricultural lands have led to the area being classified as a priority area for nitrate and the county has been rated as high use for nitrogen fertilizer, pesticide, and ag-chemical.

This assessment should be used as a basis for determining appropriate new protection measures or re-evaluating existing protection efforts. No matter what ranking a source receives, protection is always important. Whether the source is currently located in a “pristine” area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources. If the system should need to expand in the future, new well sites should be located in areas with as few potential sources of contamination as possible, and the site should be reserved and protected for this specific use.

For the Southgate Subdivision, drinking water protection activities should first focus on correcting any deficiencies outlined in the sanitary survey (an inspection conducted every five years with the purpose of determining the physical condition of a water system’s components and its capacity) including protection of the wells from surface flooding. No application or storage of herbicides, pesticides, or other chemicals is allowed within 50 feet of a public water system well. Additionally, since the delineations underlie urban and residential land, storm water drainage may be an important consideration. Should microbial contamination become a problem, appropriate disinfection practices would need to be implemented. Much of the designated protection areas are outside the direct jurisdiction of the Southgate Subdivision, making collaboration and partnerships with state and local agencies and industry groups critical to the success of drinking water protection.

If the nitrate or arsenic concentrations in the wells increase above the MCLs, the Southgate Subdivision may need to consider implementing engineering controls to protect their drinking water. Concerning the new arsenic MCL, the EPA intends to provide up to \$20 million over the next two years for research and development of more cost-effective technologies to help small systems meet the new standard and provide technical assistance to small system operators (see [www.epa.gov](http://www.epa.gov)). The EPA has also stated that it “will work with small communities to maximize grants and loans under current State Revolving Fund and Rural Utilities Service programs of the Department of Agriculture.” (USEPA, 2001, para 5).

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan as the delineation contains some urban and residential land uses. Public education topics could include proper lawn and garden care practices, household hazardous waste disposal methods, proper care and maintenance of septic systems, and the importance of water conservation to name but a few. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the EPA. As there are major transportation corridors through the delineation, the Idaho Department of Transportation should be involved in protection activities. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Soil Conservation Commission, the Canyon Soil Conservation District, and the Natural Resources Conservation Service.

A community must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (i.e. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Boise Regional Office of the Idaho Department of Environmental Quality (DEQ) or the Idaho Rural Water Association.

# SOURCE WATER ASSESSMENT FOR SOUTHGATE SUBDIVISION, CALDWELL, IDAHO

## Section 1. Introduction - Basis for Assessment

The following sections contain information necessary to understand how and why this assessment was conducted. **It is important to review this information to understand what the rankings of this assessment mean.** Maps showing the delineated source water assessment area and the inventory of significant potential sources of contamination identified within that area are included. The list of significant potential contaminant source categories and their rankings used to develop the assessment are also included.

### Background

Under the Safe Drinking Water Act Amendments of 1996, all states are required by the EPA to assess every source of public drinking water for its relative susceptibility to contaminants regulated by the Safe Drinking Water Act. This assessment is based on a land use inventory of the delineated assessment area and sensitivity factors associated with the wells and aquifer characteristics.

### Level of Accuracy and Purpose of the Assessment

Since there are over 2,900 public water sources in Idaho, there is limited time and resources to accomplish the assessments. All assessments must be completed by May of 2003. An in-depth, site-specific investigation of each significant potential source of contamination is not possible. **Therefore, this assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. The results should not be used as an absolute measure of risk and they should not be used to undermine public confidence in the water system.**

The ultimate goal of the assessment is to provide data to local communities to develop a protection strategy for their drinking water supply system. The DEQ recognizes that pollution prevention activities generally require less time and money to implement than treatment of a public water supply system once it has been contaminated. DEQ encourages communities to balance resource protection with economic growth and development. The decision as to the amount and types of information necessary to develop a drinking water protection program should be determined by the local community based on its own needs and limitations. Wellhead or drinking water protection is one facet of a comprehensive growth plan, and it can complement ongoing local planning efforts.

## **Section 2. Conducting the Assessment**

### **General Description of the Source Water Quality**

The public drinking water system for the Southgate Subdivision is comprised of two ground water wells that serve approximately 120 people through 40 connections. Well #1 supplies drinking water to the northern half of the subdivision while Well #2 supplies drinking water to the southern half.

The wells are located in Canyon County in the Southgate Subdivision off of Ustick Road in the city of Caldwell. Well #1 is located at the corner of Easy Street and Meadow Street and Well #2 is located at the corner of Meadow Street and West Ross Street (Figure 1).

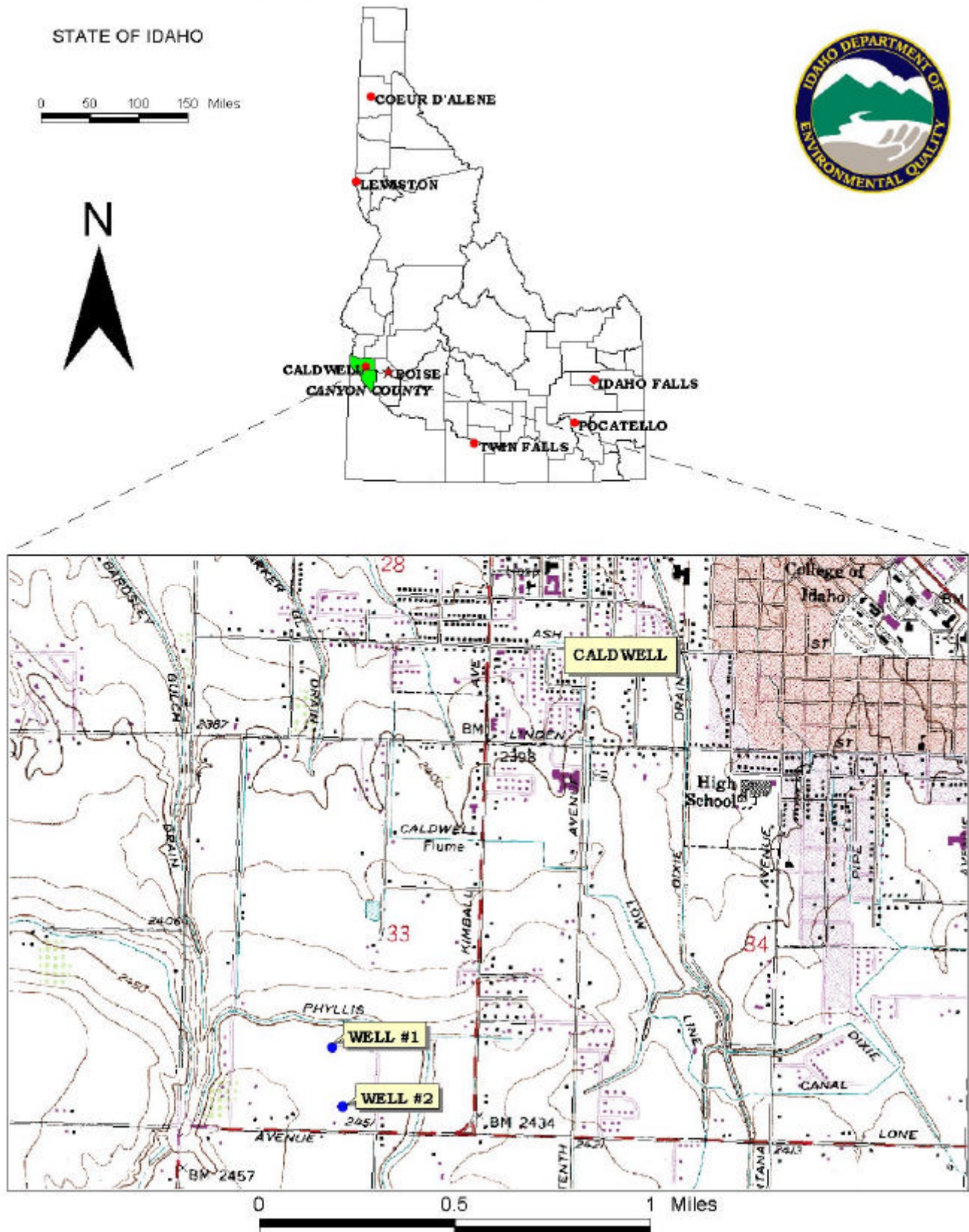
The current water chemistry issue affecting the wells of the Southgate Subdivision pertains to the detection of the total coliform bacteria in Well #2. In April 1995, total coliform bacteria were detected at the wellhead of Well #2. However, there have been no further detections of bacteria in either well or in the distribution system.

No VOCs or SOCs have been detected in the drinking water system during any water tests. The IOCs barium, arsenic, nitrate, and fluoride have been detected in the water system, but at levels below the MCLs set by the EPA. However, both arsenic and nitrate have been detected in both wells at levels greater than one-half the current MCLs. In 1995, arsenic was detected in Well #1 at 15 ppb and in Well #2 at 9 ppb. In 1998, no arsenic was detected in Well #1 and 6 ppb of arsenic was detected in Well #2. The EPA lowered the arsenic standard from 50 ppb to 10 ppb in October 2001, giving public water systems until 2006 to comply with the new requirement. Since 1993, nitrate concentrations in Well #1 have ranged from 8.86 ppm in 1997 to 5.8 ppm in 1999 with a recent detection of 8.16 ppm in 2000. For Well #2, the concentrations have ranged from 5.77 ppm in 1997 to 7.37 ppm in 2000. The nitrate MCL is 10 ppm. In addition, the surrounding agricultural lands have led to the area being classified as a priority area for nitrate and the county has been rated as high use for nitrogen fertilizer, pesticide, and ag-chemical.

### **Defining the Zones of Contribution – Delineation**

The delineation process establishes the physical area around a well that will become the focal point of the assessment. The process includes mapping the boundaries of the zone of contribution into time-of-travel (TOT) zones (zones indicating the number of years necessary for a particle of water to reach a well) for water in the aquifer. DEQ contracted with BARR Engineering to perform the delineations using a combination of MODFLOW and a refined analytical element computer model approved by the EPA in determining the 3-year (Zone 1B), 6-year (Zone 2), and 10-year (Zone 3) TOT for water associated with the Boise Valley aquifer in the vicinity of the Southgate Subdivision. The computer models used site specific data, assimilated by BARR Engineering from a variety of sources including the Southgate Subdivision well logs, other local area well logs, the Treasure Valley Hydrologic Project, and hydrogeologic reports (detailed below).

**FIGURE 1. Geographic Location of Southgate Subdivision**



## **Treasure Valley Hydrologic Project Information (Petrich and Urban, 1996; Neely and Crockett, 1998; Petrich et al., 1999)**

The “Treasure Valley” is a geopolitical region that includes the lower Boise River sub-basin. The lower Boise River sub-basin begins where the Boise River exits the mountains near the Lucky Peak Reservoir. From Lucky Peak Dam the lower Boise River flows about 64 (river) miles northwestward through the Treasure Valley to its confluence with the Snake River. The Treasure Valley Hydrologic Project area encompasses the lower Boise River area, and extends south to the Snake River. The southern area is included in the study area because of ground water flow from the Lower Boise River basin south toward the Snake River.

Significant amounts of desert area were converted to flood irrigated agriculture beginning in the 1860s. Irrigation led to increases in shallow ground water levels in some areas. The shallow ground water levels provided an inexpensive and readily obtainable water supply that is used extensively throughout the valley. Much of the population growth in the Treasure Valley has been occurring in previously flood-irrigated agricultural areas, resulting in increased pumpage and a reduction in local aquifer recharge. In addition, irrigation in some areas has become more efficient, reducing the amount of irrigation-related infiltration. Decreasing aquifer recharge and increasing pumpage is thought to be contributing to decreasing ground water levels in some areas.

The Treasure Valley experiences a temperate and arid-to-semiarid climate. Average high temperatures range from about 90°F in summer to 36°F in winter; low temperatures range from about 20°F in winter to about 56°F in summer. The average precipitation ranges from about 8 to 14 inches throughout most of the valley, most of which falls during the colder months.

Major surface water bodies include the Boise River, Lake Lowell, and Lucky Peak Reservoir. The primary source of surface water in the Treasure Valley is precipitation falling in the high elevation area in the Boise River basin upstream of Lucky Peak Dam. Much of the runoff from high elevation areas is stored in three reservoirs: Anderson Ranch Reservoir, Arrowrock Reservoir, and Lucky Peak Reservoir.

The region’s croplands are irrigated primarily with surface water through an extensive network of reservoirs and canals. The first canals were constructed in the 1860’s; there are now over 1,100 miles of major and intermediate canals in the Treasure Valley. The primary sources of the irrigation water in the Treasure Valley include the Boise, Snake, and Payette Rivers. The majority of canals are owned and maintained by canal companies and irrigation districts.

### **Hydrogeology (from Petrich et al., 1999)**

The lower Boise River sub-basin (Treasure Valley) is located within the northwest-trending topographic depression known as the western Snake River Plain. The western Snake River Plain is a relatively flat lowland separating Cretaceous granitic mountains of west-central Idaho from the granitic/volcanic Owyhee mountains in southwestern Idaho. The western Snake River Plain extends from about Twin Falls, Idaho northwestward to Vale, Oregon. The Snake River Plain is about 30 miles wide in the section containing the lower Boise River.



Sediments originating from the surrounding mountains began accumulating on top of thick, basal basalts. Rifting and continued subsidence maintained the lowland topography, leading to the additional accumulation of water and sediments (Othberg, 1994). Basin infilling by sediments and basalt occurred from the late Miocene through the late Pliocene (Othberg, 1994). Incision caused by flowing water in major drainages (e.g., Snake and Boise Rivers) began in the late Pliocene or early Pleistocene, although deposition of coarse sediments continued during Quaternary glaciations (Othberg, 1994).

Several Quaternary basalt flows have been described in the western Snake River Plain, and have been assigned to the upper Snake River Group (Malde, 1991; Malde and Powers, 1962). Lava flowed across portions of the ancestral Snake River Valley (Malde, 1991) in an area that is now south of the Boise River. The Snake River then changed course, incising at its present location along the southern margin of the basalt flows. More recent eruptions (from Kuna Butte and other local sources) spilled lava into the canyon south of Melba. The Snake River has since incised this basalt (Malde, 1991).

The general stratigraphy of the western Snake River Plain consists of (from top to bottom) a thick layer of sedimentary deposits underlain by a thick series of basalt flows, which in turn are underlain by older, tuffaceous sediments and basalt (Malde, 1991; Clemens, 1993). The upper thick zone of sediments (up to approximately 6,000 feet thick) distinguishes the western Snake River Plain from the eastern Snake River Plain, in which the upper section is primarily Quaternary basalt (Wood and Anderson, 1981).

The uppermost sediments and basalt belong to the Pleistocene-age Snake River Group. The Snake River Group consists of terrace sediments, Quaternary alluvium, and Pleistocene basalt flows (Wood and Anderson, 1981). Snake River Group sediments and basalts cover much of the project area (Othberg and Stanford, 1992).

The Snake River Group overlies the Idaho Group sediments. The Idaho Group sediments can be divided into two general parts (Wood and Anderson, 1981). The lower Idaho Group contains sediments described as lake and stream deposits of buff white, brown, and gray sand, silt, clay, diatomite, numerous thin beds of vitric ash, and some basaltic tuffs. The upper part of the lower Idaho Group also contains some local, thin, basalt flows. The upper Idaho Group consists of sands, claystones, and siltstones, but differs from the lower Idaho Group in that it contains a greater percentage of coarser-grained materials. The upper Idaho Group are associated with a fluvial/deltaic/lacustrine depositional environment; the lower Idaho Group sediments were deposited in more of a lacustrine/deltaic environment (Wood, 1994).

Wood (1994) identified a buried lacustrine delta within the Idaho Group sediments in the Nampa-Caldwell area. The location of the delta in the middle of the western Snake River Plain suggests that the eastern part of the Boise River basin was delta plain and flood plain at the time of deposition, while the western part was a deep lake environment. The delta probably prograded northwestward into a lake basin 830 feet deep, based upon high resolution seismic reflection data and resistivity log interpretations. The delta-plain and front sediments were shown to be mostly fine-grained, well-sorted sand with thin layers of mud (Wood, 1994). The northwest trend of the delta indicates a sediment source to the southeast, such as where the Snake River flows today (Wood, 1994).

A substantial, laterally extensive layer of clay is found at depths of 300 to 700 feet below ground surface. The clay is important because it represents, in some areas, a significant aquitard separating shallow overlying aquifers from deeper zones. The clay, often described in well logs as having a blue or gray color, has been observed as far west as Parma, and as far east as Boise (although the clay is not found in the extreme eastern portions of the Treasure Valley). The clay varies from a few feet to a few



hundred feet in thickness. Although significant layers of clay are present throughout the Idaho Group sediments, individual clay units are not necessarily continuous over large areas. Also, the top of the clay can vary in elevation by up to approximately 200 feet in some locations, such as in an area west of Lake Lowell. In general, sediments above the “blue clay” are coarser-grained than the interbedded sands, silts, and clays underlying the “blue clay.”

The top of the upper Idaho Group is marked in several parts of the Treasure Valley by a widespread fluvial gravel deposit known as the Tenmile Gravels. Tenmile Gravels contain rounded granitic rocks and felsic porphyries originating from the Idaho Batholith to the north and northeast. The Tenmile Gravels range up to 500 feet in thickness along the Tenmile Ridge south of Boise, but are less than 50 feet thick in the Nampa-Caldwell area (Wood and Anderson, 1981).

### **Aquifer Systems and Hydrogeologic Characteristics**

Ground water for municipal, industrial, rural domestic, and irrigation uses in the Treasure Valley is drawn almost entirely from Snake River Group and Idaho Group aquifers. Many domestic wells draw water from shallow aquifers, such as those in the Snake River Group deposits. Larger production wells (for municipal and agricultural uses) draw water from the deeper Idaho Group sediments.

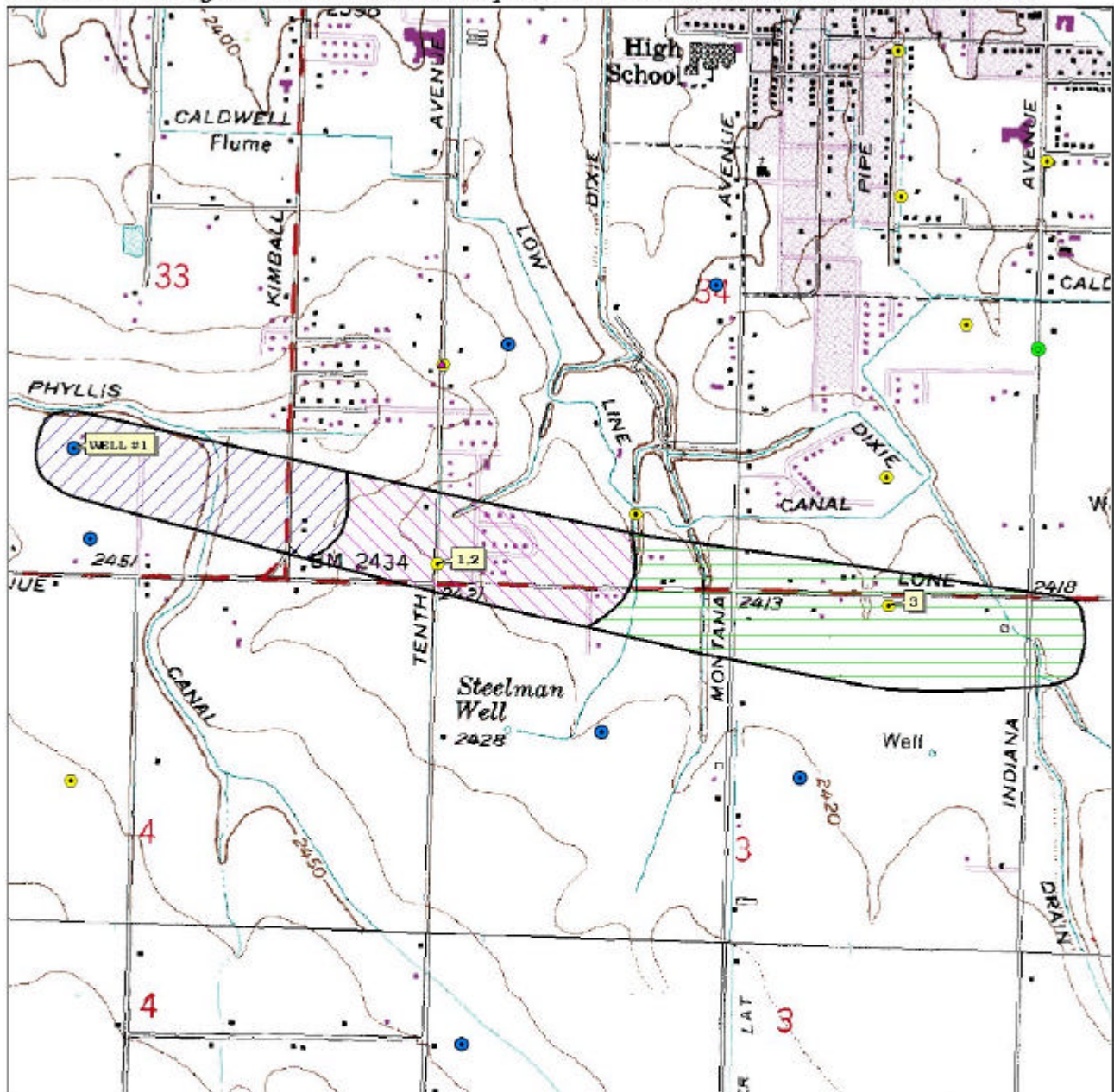
Aquifers contained in the Snake River and Idaho Group sediments comprise shallow and regional ground water flow systems. Shallow aquifers contained in Snake River Group sediments and basalts may belong to local flow systems. Most local flow system recharge stems from irrigation infiltration and channel (e.g., streams or canals) losses. Discharge from shallow, local flow systems often is to local drains or streams. The time from recharge to discharge in shallow flow systems (residence times) probably ranges from days to tens of years.

In contrast, regional ground water flow systems extend much deeper than local flow systems. The Treasure Valley regional flow system begins in the eastern part of the valley, as indicated by downward hydraulic gradients in the Boise Fan sediments described by Squires et al (1992). Some water also enters the regional flow system as underflow from the Boise Foothills in the northeastern part of the valley. The regional flow system is thought to discharge primarily to the Boise and Snake Rivers in the western and southwestern parts of the valley.

Aquifer material characteristics, material heterogeneity, and structural controls influence Treasure Valley ground water flow. Coarse-grained materials (e.g., sand and gravel) in upper zones are more capable of transmitting ground water than fine-grained sediments (e.g., silt and clay). Clay and silt in the Snake River sediments can restrict vertical and/or horizontal ground water movement. Perched aquifers are created when fine-grained lenses impede downward vertical flow. A distinctive clay layer, sometimes referred to as “blue clay,” is present over large portions of the valley. The clay is absent in the easternmost portions of the lower Boise River Basin, but can reach a thickness of more than 200 feet toward the central and western portions of the basin.

Sequences of interbedded sand, silt, and clay, such as the Deer Flat Surface and the upper portion of the Glens Ferry Formation of the upper Idaho Group in the Nampa-Caldwell area, are the major water-producing aquifers in a large part of Canyon County (Anderson and Wood, 1981). The coarse-grained sediments in this zone produce water in excess of 2,000 gallons per minute (gpm).

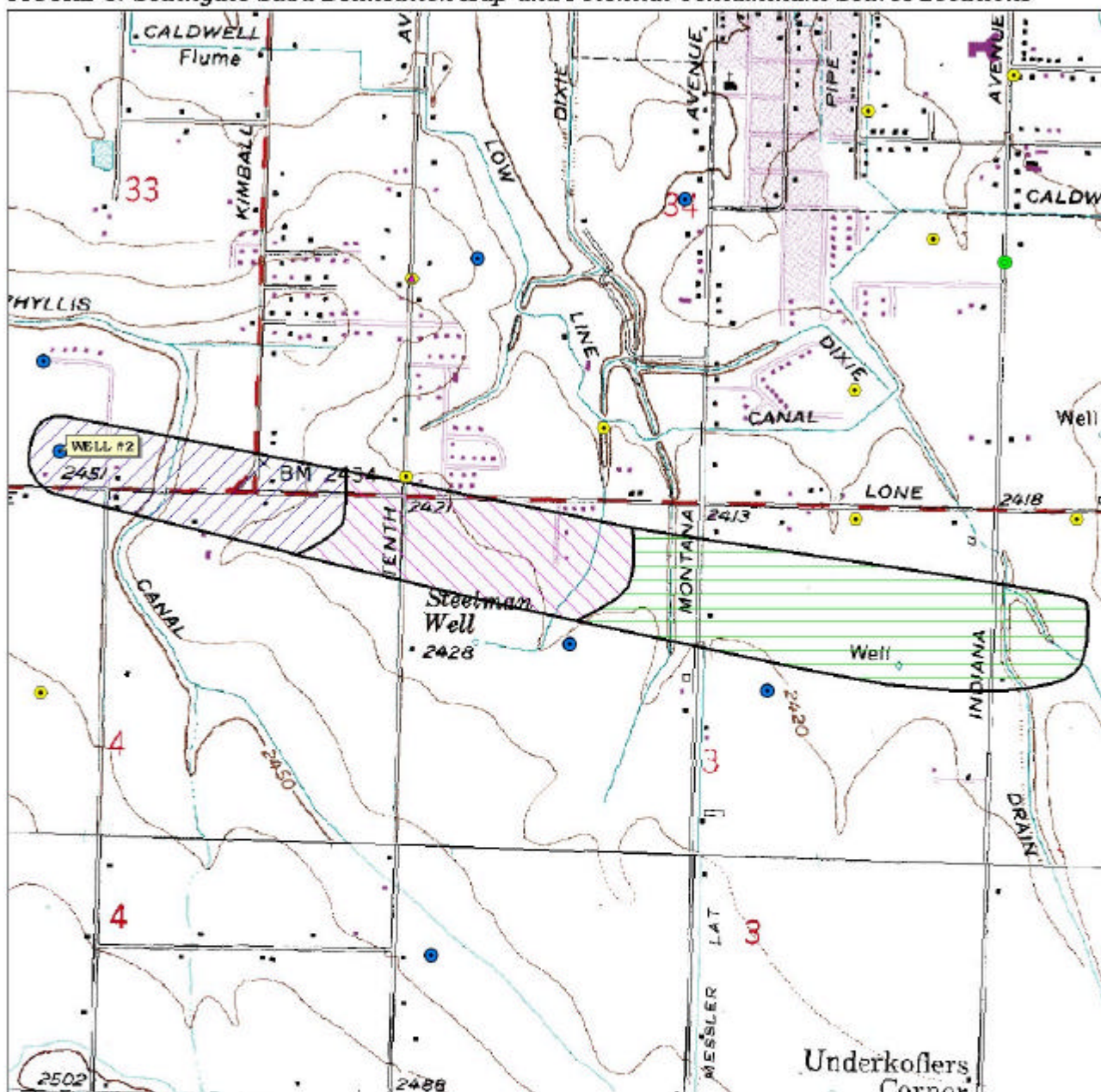
**FIGURE 2. Southgate Subd Delineation Map and Potential Contaminant Source Locations**



**PWS# 3140114**  
**WELL #1**



FIGURE 3. Southgate Subd Delineation Map and Potential Contaminant Source Locations



**PWS# 3140114**  
**WELL #2**

The delineated source water assessment areas for the wells of the Southgate Subdivision can best be described as southeastward trending corridors (Figure 2 and Figure 3) that are approximately one-fourth mile wide and approximately 2 miles long, crossing Ustick Road and Kimball Avenue in the 3-year time of travel (TOT) zone, Tenth Avenue in the 6-year TOT zone, and Indiana Avenue in the 10-year TOT zone. The actual data used by BARR Engineering in determining the source water assessment delineation areas are available from DEQ upon request.

### **Identifying Potential Sources of Contamination**

A potential source of contamination is defined as any facility or activity that stores, uses, or produces, as a product or by-product, the contaminants regulated under the Safe Drinking Water Act and has a sufficient likelihood of releasing such contaminants at levels that could pose a concern relative to drinking water sources. The goal of the inventory process is to locate and describe those facilities, land uses, and environmental conditions that are potential sources of ground water contamination. The locations of potential sources of contamination within the delineation areas were obtained by field surveys conducted by DEQ and from available databases.

Land use within the immediate area of the Southgate Subdivision wells consists of residential and agricultural property while the surrounding area consists of transportation corridors and irrigated agricultural land.

It is important to understand that a release may never occur from a potential source of contamination provided they are using best management practices. Many potential sources of contamination are regulated at the federal level, state level, or both to reduce the risk of release. Therefore, when a business, facility, or property is identified as a potential contaminant source, this should not be interpreted to mean that this business, facility, or property is in violation of any local, state, or federal environmental law or regulation. What it does mean is that the potential for contamination exists due to the nature of the business, industry, or operation. There are a number of methods that water systems can use to work cooperatively with potential sources of contamination, including educational visits and inspections of stored materials. Many owners of such facilities may not even be aware that they are located near a public water supply well.

### **Contaminant Source Inventory Process**

A two-phased contaminant inventory of the study area was conducted in October and November 2001. The first phase involved identifying and documenting potential contaminant sources within the Southgate Subdivision source water assessment areas (Figure 2 and Figure 3) through the use of computer databases and Geographic Information System maps developed by DEQ. The second, or enhanced, phase of the contaminant inventory involved contacting the operator to identify and add any additional potential sources in the area.

The delineated source water areas for the Southgate Subdivision wells contain a couple of transportation corridors: Kimball Avenue and Ustick Road and surface waters: Phyllis Canal and Dixie Drain (Table 1 and Table 2). The delineation for Well #1 also contains a veterinary clinic and a diesel engine wholesale business (Table 1). Additionally, the 1995 Ground Water Under Direct Influence (GWUDI) field survey indicates that septic systems for the subdivision are located within 400 feet of Well #2. Though this source is not listed in Table 2, it was used in assessing the susceptibility of Well #2 to potential contaminants. The potential contaminant sources can potentially add contaminants to the aquifer in the event of an accidental spill or release or surface flooding.

**Table 1. Southgate Subdivision Wells #1, Potential Contaminant Inventory**

Site #	Source Description <sup>1</sup>	TOT Zone <sup>2</sup> (Years)	Source of Information	Potential Contaminants <sup>3</sup>
1, 2	Veterinarians	3 – 6	Database Search	IOC, VOC, SOC
3	Engines-Diesel (Wholesale)	3 – 6	Database Search	IOC, VOC, SOC
	Kimball Avenue	0 – 3	GIS Map	IOC, VOC, SOC, Microbes
	Phyllis Canal	0 – 3	GIS Map	IOC, VOC, SOC, Microbes
	Ustick Road	3 – 10	GIS Map	IOC, VOC, SOC
	Dixie Drain	6 – 10	GIS Map	IOC, VOC, SOC

<sup>2</sup> TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead

<sup>3</sup> IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

**Table 2. Southgate Subdivision Wells #2, Potential Contaminant Inventory**

Site #	Source Description <sup>1</sup>	TOT Zone <sup>2</sup> (Years)	Source of Information	Potential Contaminants <sup>3</sup>
	Kimball Avenue	0 – 3	GIS Map	IOC, VOC, SOC, Microbes
	Phyllis Canal	0 – 3	GIS Map	IOC, VOC, SOC, Microbes
	Ustick Road	0 – 6	GIS Map	IOC, VOC, SOC, Microbes
	Dixie Drain	6 – 10	GIS Map	IOC, VOC, SOC

<sup>2</sup> TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead

<sup>3</sup> IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

### Section 3. Susceptibility Analyses

Each well's susceptibility to contamination was ranked as high, moderate, or low risk according to the following considerations: hydrologic characteristics, physical integrity of the well, land use characteristics, and potentially significant contaminant sources. The susceptibility rankings are specific to a particular potential contaminant or category of contaminants. Therefore, a high susceptibility rating relative to one potential contaminant does not mean that the water system is at the same risk for all other potential contaminants. The relative ranking that is derived for each well is a qualitative, screening-level step that, in many cases, uses generalized assumptions and best professional judgement. Attachment A contains the susceptibility analysis worksheet. The following summaries describe the rationale for the susceptibility ranking.

#### Hydrologic Sensitivity

The hydrologic sensitivity rating of a well is dependent upon four factors: the surface soil composition, the material in the vadose zone (between the land surface and the water table), the depth to first ground water, and the presence of a 50-foot thick fine-grained zone above the producing zone of the well. Slowly draining soils such as silt and clay typically are more protective of ground water than coarse-grained soils such as sand and gravel. Similarly, fine-grained sediments in the subsurface and a water depth of more than 300 feet protect the ground water from contamination.

Hydrologic sensitivity is moderate for Well #1 and high for Well #2. Regional soils data indicates that the area consists predominantly of moderate to well-drained soils. The well log for Well #1 indicates the presence of a 70-foot clay layer above the producing zone, decreasing the potential downward migration of contaminants to the aquifer. The depth to first ground water for Well #1 is found between 48 and 53 feet below ground surface (bgs) and for Well #2, first ground water is found between 49 and 58 feet bgs.

## Well Construction

Well construction directly affects the ability of the well to protect the aquifer from contaminants. System construction scores are reduced when information shows that potential contaminants will have a more difficult time reaching the intake of the well. Lower scores imply a system is less vulnerable to contamination. For example, if the well casing and annular seal both extend into a low permeability unit, then the possibility of contamination is reduced and the system construction score goes down. If the highest production interval is more than 100 feet below the water table, then the system is considered to have better buffering capacity. If the wellhead and surface seal are maintained to standards, as outlined in sanitary surveys, then contamination down the well bore is less likely. If the well is protected from surface flooding and is outside the 100-year floodplain, then contamination from surface events is reduced. A sanitary survey for the wells was conducted in 1995.

Well #1 has a moderate system construction score and Well #2 has a high system construction score. The 1997 sanitary survey shows that the wellheads and surface seals meet standards for both wells but that only Well #1 is properly protected from flooding. One of the deficiencies listed on the survey is that the casing vent of Well #2 is not downturned or screened. The well logs provided specific well construction details.

Well #1 was first drilled in 1970 and deepened in 1973. The final depth of the well is 215 feet bgs. It has a 0.250-inch thick, 12-inch diameter casing set to a depth of 133.5 feet bgs into “hard yellow clay.” In the deepening of the well, a 0.250-inch thick, 10-inch diameter casing was added from 115 feet to 215 feet bgs into “sand.” The annular seal was installed to a depth of 20 feet bgs into “sand and gravel.” The well is not screened but perforated between 125 and 205 feet bgs. The static water level for Well #1 is found at 50 feet bgs. Well #2 was drilled in 1973 to a depth of 75 feet bgs. It has a 0.250-inch, 14-inch diameter casing set to a depth of 74 feet bgs into “soft yellow clay and sand.” The annular seal was installed to a depth of 20 feet bgs into “sand and gravel.” The well is not screened or perforated and the static water level is found at 37 feet bgs.

The available well logs allowed a determination as to whether current public water system (PWS) construction standards are being met. Though the wells may have been in compliance with standards when they were completed, current PWS well construction standards are more stringent. The Idaho Department of Water Resources *Well Construction Standards Rules* (1993) require all PWSs to follow DEQ standards as well. IDAPA 58.01.08.550 requires that PWSs follow the *Recommended Standards for Water Works* (1997) during construction. Some of the regulations deal with screening requirements, aquifer pump tests, surface casing vent, and thickness of casing. Table 1 of the *Recommended Standards for Water Works* (1997) lists the required steel casing thickness for various diameter wells. Ten-inch diameter wells require a casing thickness of 0.365-inches and twelve to twenty-inch diameter wells require a casing thickness of 0.375-inches.

## Potential Contaminant Source and Land Use

Well #1 rates high for IOCs (i.e. nitrates, arsenic) and SOCs (i.e. pesticides), moderate for VOCs (i.e. petroleum products), and low for microbial contaminants (i.e. bacteria). Well #2 rates high for IOCs, VOCs, and SOCs, and moderate for microbial contaminants. The extensive irrigated agricultural land and the nitrate priority area as well as the transportation corridors and the canal that all lie in the 3-year TOT contributed to the high land use ratings. The septic system that lies within 400 feet of Well #2 also contributed to land use ratings for that well.

## Final Susceptibility Ranking

A detection above a drinking water standard MCL, any detection of a VOC or SOC, or a detection of total coliform bacteria or fecal coliform bacteria at the wellhead will automatically give a high susceptibility rating to a well despite the land use of the area because a pathway for contamination already exists. Additionally, storing potential contaminant sources within 50 feet of a wellhead will automatically lead to a high susceptibility rating. Hydrologic sensitivity and system construction scores are heavily weighted in the final scores. Having multiple potential contaminant sources in the 0- to 3-year time of travel zone (Zone 1B) and agricultural land contribute greatly to the overall ranking. In terms of total susceptibility, Well #1 of the Southgate Subdivision rate high susceptibility to IOCs and moderate susceptibility to VOCs, SOCs, and microbial contaminants. Well #2 rates high susceptibility to all potential contaminant categories.

**Table 3. Summary of Southgate Subdivision Susceptibility Evaluation**

Well	Susceptibility Scores <sup>1</sup>									
	Hydrologic Sensitivity	Contaminant Inventory				System Construction	Final Susceptibility Ranking			
		IOC	VOC	SOC	Microbials		IOC	VOC	SOC	Microbials
Well #1	M	H	M	H	L	M	H	M	M	M
Well #2	H	H	H	H	M	H	H	H	H	H(*)

<sup>1</sup>H = High Susceptibility, M = Moderate Susceptibility, L = Low Susceptibility,

IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

H(\*)=High number of points and an automatic high susceptibility rating due to the detection total coliform bacteria at the wellhead in 1995

## Susceptibility Summary

Well #1 of the Southgate Subdivision has a high susceptibility to IOCs and a moderate susceptibility to VOCs, SOCs, and microbial contaminants. Well #2 has a high susceptibility to all potential contaminant categories with an automatic high susceptibility to microbial contaminants due to a detection of total coliform bacteria at the wellhead in 1995. The overall high susceptibility rankings of Well #2 can be attributed to the high hydrologic sensitivity around the well and the deficient flood protection of the well, resulting in a high system construction score. The extensive irrigated agricultural land within the area of the wells also contributed to the overall susceptibility of both wells.

The current water chemistry issue affecting the wells of the Southgate Subdivision pertains to the detection of total coliform bacteria in Well #2. In April 1995, total coliform bacteria were detected at the wellhead of Well #2. However, there have been no further detections of bacteria in either well or in the distribution system.

No VOCs or SOCs have been detected in the drinking water system during any water tests. The IOCs barium, arsenic, nitrate, and fluoride have been detected in the water system, but at levels below the MCLs set by the EPA. However, both arsenic and nitrate have been detected in both wells at levels greater than one-half the current MCLs. In 1995, arsenic was detected in Well #1 at 15 ppb and in Well #2 at 9 ppb. In 1998, no arsenic was detected in Well #1 and 6 ppb of arsenic was detected in Well #2. The EPA lowered the arsenic standard from 50 ppb to 10 ppb in October 2001, giving public water systems until 2006 to comply with the new requirement. Since 1993, nitrate concentrations in Well #1 have ranged from 8.86 ppm in 1997 to 5.8 ppm in 1999 with a recent detection of 8.16 ppm in



2000. For Well #2, the concentrations have ranged from 5.77 ppm in 1997 to 7.37 ppm in 2000. The nitrate MCL is 10 ppm. In addition, the surrounding agricultural lands have led to the area being classified as a priority area for nitrate and the county has been rated as high use for nitrogen fertilizer, pesticide, and ag-chemical.

## **Section 4. Options for Drinking Water Protection**

The susceptibility assessment should be used as a basis for determining appropriate new protection measures or re-evaluating existing protection efforts. No matter what the susceptibility ranking a source receives, protection is always important. Whether the source is currently located in a “pristine” area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources.

An effective drinking water protection program is tailored to the particular local drinking water protection area. A community with a fully developed drinking water protection program will incorporate many strategies. For the Southgate Subdivision, drinking water protection activities should first focus on correcting any deficiencies outlined in the sanitary survey. No application or storage of herbicides, pesticides, or other chemicals is allowed within 50 feet of a public water system well. Additionally, since the delineations underlie urban and residential land, storm water drainage may be an important consideration. Should microbial contamination become a problem, appropriate disinfection practices would need to be implemented. Much of the designated protection areas are outside the direct jurisdiction of the Southgate Subdivision, making collaboration and partnerships with state and local agencies and industry groups critical to the success of drinking water protection.

If the nitrate or arsenic concentrations in the wells increase above the MCLs, the Southgate Subdivision may need to consider implementing engineering controls to protect their drinking water. Concerning the new arsenic MCL, the EPA intends to provide up to \$20 million over the next two years for research and development of more cost-effective technologies to help small systems meet the new standard and provide technical assistance to small system operators (see [www.epa.gov](http://www.epa.gov)). The EPA has also stated that it “will work with small communities to maximize grants and loans under current State Revolving Fund and Rural Utilities Service programs of the Department of Agriculture.” (USEPA, 2001, para 5).

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan as the delineation contains some urban and residential land uses. Public education topics could include proper lawn and garden care practices, household hazardous waste disposal methods, proper care and maintenance of septic systems, and the importance of water conservation to name but a few. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the U.S. EPA. As there are major transportation corridors through the delineation, the Idaho Department of Transportation should be involved in protection activities. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Soil Conservation Commission, the Canyon Soil Conservation District, and the Natural Resources Conservation Service.

A community must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (i.e. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Boise Regional Office of the DEQ or the Idaho Rural Water Association.

### **Assistance**

Public water supplies and others may call the following DEQ offices with questions about this assessment and to request assistance with developing and implementing a local protection plan. In addition, draft protection plans may be submitted to the DEQ office for preliminary review and comments.

Boise Regional DEQ Office                      (208) 373-0550

State DEQ Office                                      (208) 373-0502

Website: <http://www.deq.state.id.us>

Water suppliers serving fewer than 10,000 persons may contact Melinda Harper, Idaho Rural Water Association, at (208) 373-7001 (mharper@idahoruralwater.com) for assistance with drinking water protection (formerly wellhead protection) strategies.

## POTENTIAL CONTAMINANT INVENTORY

### LIST OF ACRONYMS AND DEFINITIONS

**AST (Aboveground Storage Tanks)** – Sites with aboveground storage tanks.

**Business Mailing List** – This list contains potential contaminant sites identified through a yellow pages database search of standard industry codes (SIC).

**CERCLIS** – This includes sites considered for listing under the **Comprehensive Environmental Response Compensation and Liability Act (CERCLA)**. CERCLA, more commonly known as ASuperfund, is designed to clean up hazardous waste sites that are on the national priority list (NPL).

**Cyanide Site** – DEQ permitted and known historical sites/facilities using cyanide.

**Dairy** – Sites included in the primary contaminant source inventory represent those facilities regulated by Idaho State Department of Agriculture (ISDA) and may range from a few head to several thousand head of milking cows.

**Deep Injection Well** – Injection wells regulated under the Idaho Department of Water Resources generally for the disposal of stormwater runoff or agricultural field drainage.

**Enhanced Inventory** – Enhanced inventory locations are potential contaminant source sites added by the water system. These can include new sites not captured during the primary contaminant inventory, or corrected locations for sites not properly located during the primary contaminant inventory. Enhanced inventory sites can also include miscellaneous sites added by the Idaho Department of Environmental Quality (DEQ) during the primary contaminant inventory.

**Floodplain** – This is a coverage of the 100year floodplains.

**Group 1 Sites** – These are sites that show elevated levels of contaminants and are not within the priority one areas.

**Inorganic Priority Area** – Priority one areas where greater than 25% of the wells/springs show constituents higher than primary standards or other health standards.

**Landfill** – Areas of open and closed municipal and non-municipal landfills.

**LUST (Leaking Underground Storage Tank)** – Potential contaminant source sites associated with leaking underground storage tanks as regulated under RCRA.

**Mines and Quarries** – Mines and quarries permitted through the Idaho Department of Lands.)

**Nitrate Priority Area** – Area where greater than 25% of wells/springs show nitrate values above 5mg/l.

**NPDES (National Pollutant Discharge Elimination System)** – Sites with NPDES permits. The Clean Water Act requires that any discharge of a pollutant to waters of the United States from a point source must be authorized by an NPDES permit.

**Organic Priority Areas** – These are any areas where greater than 25 % of wells/springs show levels greater than 1% of the primary standard or other health standards.

**Recharge Point** – This includes active, proposed, and possible recharge sites on the Snake River Plain.

**RICRIS** – Site regulated under **Resource Conservation Recovery Act (RCRA)**. RCRA is commonly associated with the cradle to grave management approach for generation, storage, and disposal of hazardous wastes.

**SARA Tier II (Superfund Amendments and Reauthorization Act Tier II Facilities)** – These sites store certain types and amounts of hazardous materials and must be identified under the Community Right to Know Act.

**Toxic Release Inventory (TRI)** – The toxic release inventory list was developed as part of the Emergency Planning and Community Right to Know (Community Right to Know) Act passed in 1986. The Community Right to Know Act requires the reporting of any release of a chemical found on the TRI list.

**UST (Underground Storage Tank)** – Potential contaminant source sites associated with underground storage tanks regulated as regulated under RCRA.

**Wastewater Land Applications Sites** – These are areas where the land application of municipal or industrial wastewater is permitted by DEQ.

**Wellheads** – These are drinking water well locations regulated under the Safe Drinking Water Act. They are not treated as potential contaminant sources.

**NOTE:** Many of the potential contaminant sources were located using a geocoding program where mailing addresses are used to locate a facility. Field verification of potential contaminant sources is an important element of an enhanced inventory.

Where possible, a list of potential contaminant sites unable to be located with geocoding will be provided to water systems to determine if the potential contaminant sources are located within the source water assessment area.

## References Cited

- Anderson, J.E. and Wood, S.H., 1981. Geological, Hydrological Geochemical and Geophysical Investigations of the Nampa-Caldwell and Adjacent Areas, Southwestern Idaho. Chapter 3, Geohydrology, In: Mitchell, J. C., ed., Geothermal Investigations in Idaho, Part 11: Idaho Department of Water Resources, Water Information Bulletin 30: p. 33-42.
- Clemens, D.M., 1993. Volcanic stratigraphy and tectonic development, Western Snake River Plain, Idaho. M.S. Thesis, Arizona State University.
- “EPA Announces Arsenic Standard for Drinking Water of 10 parts per billion.” Retrieved November 1, 2001 from EPA, EPA Newsroom website: [http://www.epa.gov/epahome/headline\\_110101.htm](http://www.epa.gov/epahome/headline_110101.htm)
- Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 1997. “Recommended Standards for Water Works.”
- Idaho Department of Agriculture, 1998. Unpublished Data.
- Idaho Department of Environmental Quality, 1997. Design Standards for Public Drinking Water Systems. IDAPA 58.01.08.550.01.
- Idaho Department of Water Resources, 1993. Administrative Rules of the Idaho Water Resource Board: Well Construction Standards Rules. IDAPA 37.03.09.
- Malde, H.E., 1991. Quaternary geology and structural history of the Snake River Plain, Idaho and Oregon. In: The Geology of North America, Quaternary Nonglacial Geology: Conterminous U.S., Vol. K-2, 252-281 pp.
- Malde, H.E. and Powers, H.A., 1962. Upper Cenozoic stratigraphy of Western Snake River Plain. Geological Society of America Bulletin, 73: 1197-1220.
- Neely, K.W. and J.K. Crockett, 1998. “Ground Water Quality Characterization and Initial Trend Analyses for the Treasure Valley Shallow and Deep Hydrogeologic Subareas,” Idaho Department of Water Resources, Water Information Bulletin No. 50, Part 3.
- Othberg, K.L., 1994. Geology and geomorphology of the Boise Valley and adjoining areas, western Snake River Plain, Idaho. Idaho Geological Survey Bulletin 29: 54 pp.
- Othberg, K.L. and Stanford, L., 1992. Geologic map of the Boise Valley and adjoining area, Western Snake River Plain, Idaho. Idaho Geological Survey.
- Petrich, C.R. and S.M. Urban, 1996. “Treasure Valley Hydrologic Project Background – Draft,” September, 1996.
- Petrich, C.R. and J.H. Hutchings (IWRRI), S.M. Urban and R.A. Carlson (IDWR), 1999. “Progress Report on the Characterization of Treasure Valley Ground Water Resources – Draft,” prepared for and in cooperation with the Idaho Department of Water Resources, June 30, 1999.

- Squires, E., Wood, S.H. and Osiensky, J.L., 1992. Hydrogeologic Framework of the Boise Aquifer System, Ada County, Idaho, Research Technical Completion Report, Idaho Water Resources Research Institute, University of Idaho. 114 pp.
- Wood, S.H., 1994. Seismic expression and geological significance of a lacustrine delta in Neogene deposits of the Western Snake River Plain, Idaho. AAPG Bulletin, 1(January): p. 102-121.
- Wood, S.H. and Anderson, J.E., 1981. Part 11: Geological, hydrological, and geochemical and Geophysical investigations of the Nampa-Caldwell and adjacent areas, southwestern Idaho. In: J.C. Mitchell (Editor), Geothermal investigations in Idaho. Idaho Department of Water Resources.
- Wuolo, R.W., J. Wittman, and D.M. Reynolds, 2001. "Summary Report: Delineation of Public Drinking Water Sources for the Source Water Assessment Program: Boise Valley and Mountain Home Plateau," BARR, Minneapolis, August 2001.

## Attachment A

### Southgate Subdivision Susceptibility Analysis Worksheets

The final scores for the susceptibility analysis were determined using the following formulas:

- 1) VOC/SOC/IOC Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.2)
- 2) Microbial Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.375)

Final Susceptibility Scoring:

0 - 5    Low Susceptibility

6 - 12   Moderate Susceptibility

≥ 13    High Susceptibility



1. System Construction		SCORE			
Drill Date	6/6/1973				
Driller Log Available	YES				
Sanitary Survey (if yes, indicate date of last survey)	YES	1995			
Well meets IDWR construction standards	NO	1			
Wellhead and surface seal maintained	YES	0			
Casing and annular seal extend to low permeability unit	NO	2			
Highest production 100 feet below static water level	NO	1			
Well located outside the 100 year flood plain	YES	0			
Total System Construction Score		4			
2. Hydrologic Sensitivity					
Soils are poorly to moderately drained	NO	2			
Vadose zone composed of gravel, fractured rock or unknown	YES	1			
Depth to first water > 300 feet	NO	1			
Aquitard present with > 50 feet cumulative thickness	YES	0			
Total Hydrologic Score		4			
3. Potential Contaminant / Land Use - ZONE 1A		IOC Score	VOC Score	SOC Score	Microbial Score
Land Use Zone 1A	IRRIGATED CROPLAND	2	2	2	2
Farm chemical use high	YES	2	0	2	
IOC, VOC, SOC, or Microbial sources in Zone 1A	NO	NO	NO	NO	NO
Total Potential Contaminant Source/Land Use Score - Zone 1A		4	2	4	2
Potential Contaminant / Land Use - ZONE 1B					
Contaminant sources present (Number of Sources)	YES	2	2	2	2
(Score = # Sources X 2 ) 8 Points Maximum		4	4	4	4
Sources of Class II or III leacheable contaminants or	YES	6	2	2	
4 Points Maximum		4	2	2	
Zone 1B contains or intercepts a Group 1 Area	YES	2	0	0	0
Land use Zone 1B Greater Than 50% Irrigated Agricultural Land		4	4	4	4
Total Potential Contaminant Source / Land Use Score - Zone 1B		14	10	10	8
Potential Contaminant / Land Use - ZONE II					
Contaminant Sources Present	YES	2	2	2	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Land Use Zone II 25 to 50% Irrigated Agricultural Land		1	1	1	
Potential Contaminant Source / Land Use Score - Zone II		4	4	4	0
Potential Contaminant / Land Use - ZONE III					
Contaminant Source Present	YES	1	1	1	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Is there irrigated agricultural lands that occupy > 50% of	YES	1	1	1	
Total Potential Contaminant Source / Land Use Score - Zone III		3	3	3	0
Cumulative Potential Contaminant / Land Use Score		25	19	21	10
4. Final Susceptibility Source Score		13	12	12	12
5. Final Well Ranking		High	Moderate	Moderate	Moderate

1. System Construction		SCORE			
	Drill Date	5/30/1973			
	Driller Log Available	YES			
	Sanitary Survey (if yes, indicate date of last survey)	YES	1995		
	Well meets IDWR construction standards	NO	1		
	Wellhead and surface seal maintained	YES	0		
	Casing and annular seal extend to low permeability unit	NO	2		
	Highest production 100 feet below static water level	NO	1		
	Well located outside the 100 year flood plain	NO	1		
Total System Construction Score			5		
2. Hydrologic Sensitivity					
	Soils are poorly to moderately drained	NO	2		
	Vadose zone composed of gravel, fractured rock or unknown	YES	1		
	Depth to first water > 300 feet	NO	1		
	Aquitard present with > 50 feet cumulative thickness	NO	2		
Total Hydrologic Score			6		
3. Potential Contaminant / Land Use - ZONE 1A		IOC Score	VOC Score	SOC Score	Microbial Score
	Land Use Zone 1A	IRRIGATED CROPLAND	2	2	2
	Farm chemical use high	YES	0	2	
	IOC, VOC, SOC, or Microbial sources in Zone 1A	YES	NO	NO	YES
Total Potential Contaminant Source/Land Use Score - Zone 1A		4	2	4	2
Potential Contaminant / Land Use - ZONE 1B					
	Contaminant sources present (Number of Sources)	YES	3	3	3
	(Score = # Sources X 2 ) 8 Points Maximum		6	6	6
	Sources of Class II or III leacheable contaminants or	YES	7	3	
	4 Points Maximum		4	3	
	Zone 1B contains or intercepts a Group 1 Area	YES	2	0	0
	Land use Zone 1B Greater Than 50% Irrigated Agricultural Land		4	4	4
Total Potential Contaminant Source / Land Use Score - Zone 1B		16	13	13	10
Potential Contaminant / Land Use - ZONE II					
	Contaminant Sources Present	YES	2	2	2
	Sources of Class II or III leacheable contaminants or	YES	1	1	1
	Land Use Zone II Greater Than 50% Irrigated Agricultural Land		2	2	
Potential Contaminant Source / Land Use Score - Zone II		5	5	5	0
Potential Contaminant / Land Use - ZONE III					
	Contaminant Source Present	YES	1	1	1
	Sources of Class II or III leacheable contaminants or	YES	1	1	1
	Is there irrigated agricultural lands that occupy > 50% of	YES	1	1	
Total Potential Contaminant Source / Land Use Score - Zone III		3	3	3	0
Cumulative Potential Contaminant / Land Use Score		28	23	25	12
4. Final Susceptibility Source Score		17	16	16	15
5. Final Well Ranking		High	High	High	High